

**CLAIMS**

1. A method of treating particulate material to form a solid aggregate matrix including the steps of:
  - 5 - providing a urea formaldehyde precondensate;
  - providing a polar solvent;
  - providing additional urea;
  - providing an acid or salt thereof;
  - mixing the polar solvent, additional urea, precondensate, and  
10 acid to form a binder composition;
  - mixing the binder composition with the particulate material; and
  - allowing the binder composition to set over a period of time longer than 30 minutes to form a solid aggregate matrix,  
the acid or salt thereof being selected such as to render the pH of the  
15 binder composition to a value from 2.0 to 5.3.
2. A method according to claim 1 wherein the polar solvent is selected from the group consisting of water, alcohol, and mixtures thereof.
- 20 3. A method according to claim 1 or claim 2 which includes the further step of adding a sugar prior to the step of setting.
4. A method according to claim 3 wherein the sugar is selected from the

group consisting of sucrose, glucose and fructose and mixtures thereof.

5. A method according to any one of the preceding claims which includes the further step of adding a binding promoter for enhancing the binding between the binder composition and the particulate material, prior to the step of setting.

6. A method according to claim 5 wherein the binding promoter is a complex fatty acid derived from the complete oxidation of vegetable sugars.

7. A method according to claim 5 or 6 wherein, more particularly, the binding promoter is selected from the group consisting of humic acid, fulmic acid, salts and mixtures thereof.

8. A method according to claim 5 wherein the binding promoter is bitumen.

9. A method according to claim 8 wherein the bitumen is in the form of an anionic bitumen emulsion.

10. A method according to claim 5 wherein the binding promoter is in the

form of a surfactant.

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11. A method according to claim 10 wherein the surfactant is in the form of sodium dodecyl bensene.
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12. A method according to any one of the preceding claims which includes the further step of adding any one or more agents selected from the group consisting of silicones, silanes, silanols, oils, anti - corrosion agents, ultra violet light blocking agents, biocides, pH buffers, cement, ammonia, ammonium salts, plasticisers, ligna sulphinates and oxides thereof, phenols and mixtures thereof, prior to setting.
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13. A method according to claim 12 wherein the plasticisers are selected from the group consisting of phthalates, hydrocarbons, acetates, latex and glycols.
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14. A method according to claim 12 or 13 wherein the ultra violet light blocking agents are selected from the group consisting of organic phenols, phosphates and inorganic oxides.
15. A method according to any one of the preceding claims wherein the particulate material is selected from the group consisting of sand, soil,

gravel, natural or synthetic fibres including glass-, steel-, carbon- and polymeric fibres, clay, silicas, particulate ore, rubber, stones, pebbles, partly bound cementitious masses, grass, slag, waste dump material, coal particles, ash, and mixtures thereof.

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16. A method according to any one of the preceding claims wherein the formaldehyde : urea ratio in the binder composition is between 1.5 and 2.5 : 1.

10 17. A method according to claim 16 wherein the formaldehyde : urea ratio in the binder composition is 1.83 : 1.

15 18. A method according to any one of the preceding claims which includes the further step of compacting the aggregate matrix after the step of mixing and prior to the step of setting into a solid.

19. A method according to any one of the preceding claims wherein the acid is a weak organic acid.

20 20. A method according to claim 19 wherein the weak organic acid is selected from the group consisting of citric acid and acetic acid and mixtures thereof.

21. A method of preparing a binder composition for treating particulate material to form a solid aggregate matrix including the steps of:
- providing a urea formaldehyde precondensate;
  - providing a polar solvent;
  - 5 - providing additional urea;
  - providing an acid or salt thereof;
  - mixing the additional urea, polar solvent, urea formaldehyde precondensate, and acid to form a binder composition which sets into a solid over a period of longer than 30 minutes from
  - 10 being mixed with the said particulate material,
- the acid or salt thereof being selected such as to render the pH of the binder composition to a value from 2.0 to 5.3.
22. A method according to claim 21 wherein the polar solvent is selected
- 15 from the group consisting of water, alcohol, and mixtures thereof.
23. A method according to claim 21 or claim 22 which includes the further step of adding a sugar prior to the step of setting.
- 20 24. A method according to claim 23 wherein the sugar is selected from the group consisting of sucrose, glucose and fructose and mixtures thereof.

25. A method according to any one of claims 21 to 24 which includes the further step of adding a binding promoter for enhancing the binding between the binder composition and the particulate material.
- 5 26. A method according to claim 25 wherein the binding promoter is a complex fatty acid derived from the complete oxidation of vegetable sugars.
- 10 27. A method according to claim 25 or 26 wherein, more particularly, the binding promoter is selected from the group consisting of humic acid, fulmic acid, salts and mixtures thereof.
- 15 28. A method according to claim 25 wherein the binding promoter is bitumen.
- 20 29. A method according to claim 28 wherein the bitumen is in the form of an anionic bitumen emulsion.
30. A method according to claim 25 wherein the binding promoter is in the form of a surfactant.
31. A method according to claim 30 wherein the surfactant is in the form of sodium dodecyl benzene.

32. A method according to any one of claims 21 to 31 which includes the further step of adding any one or more agents selected from the group consisting of silicones, silanes, silanols, oils, anti - corrosion agents, ultra violet light blocking agents, biocides, pH buffers, cement, ammonia, ammonium salts, plasticisers, ligna sulphinates and oxides thereof, phenols and mixtures thereof.
33. A method according to claim 32 wherein the plasticisers are selected from the group consisting of phthalates, hydrocarbons, acetates, latex and glycols.
34. A method according to claim 32 or 33 wherein the ultra violet light blocking agents are selected from the group consisting of organic phenols, phosphates and inorganic oxides.
35. A method according to any one of claims 21 to 34 wherein the particulate material is selected from the group consisting of sand, soil, gravel, natural or synthetic fibres including glass-, steel-, carbon- and polymeric fibres, clay, silicas, particulate ore, rubber, stones, pebbles, partly bound cementitious masses, grass, slag, waste dump material, coal particles, ash, and mixtures thereof.

36. A method according to any one of claims 21 to 35 wherein the formaldehyde : urea ratio in the binder composition is between 1.5 and 2.5 : 1.
- 5 37. A method according to claim 36 wherein the formaldehyde : urea ratio in the binder composition is 1.83 : 1.
38. A method according to any one claims 21 to 37 wherein the acid is a weak organic acid.
- 10 39. A method according to claim 39 wherein the weak organic acid is selected from the group consisting of citric acid and acetic acid and mixtures thereof.
- 15 40. A settable binder composition for mixing with a particulate material and setting to form a solid aggregate matrix, the binder composition comprising a mixture of a urea formaldehyde precondensate; a polar solvent; additional urea; and an acid or salt thereof selected such as to render the pH of the binder composition to a value from 2.0 to 5.3
- 20 so that the binder composition sets into a solid over a period of time longer than 30 minutes from being mixed with the particulate material.
41. A binder composition according to claim 40 wherein the polar solvent



is selected from the group consisting of water, alcohol, and mixtures thereof.

5 42. A binder composition according to claim 40 or claim 41 which further includes a sugar.

43. A binder composition according to claim 42 wherein the sugar is selected from the group consisting of sucrose, glucose and fructose and mixtures thereof.

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44. A binder composition according to any one of claims 40 to 43 which includes a binding promoter for enhancing the binding between the binder composition and the particulate material.

15 45. A binder composition according to claim 44 wherein the binding promoter is a complex fatty acid derived from the complete oxidation of vegetable sugars.

20 46. A binder composition according to claim 44 or 45 wherein, more particularly, the binding promoter is selected from the group consisting of humic acid, fulmic acid, salts and mixtures thereof.

47. A binder composition according to claim 44 wherein the binding

promoter is bitumen.

48. A binder composition according to claim 47 wherein the bitumen is in the form of an anionic bitumen emulsion.

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49. A binder composition according to claim 44 wherein the binding promoter is in the form of a surfactant.

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50. A binder composition according to claim 49 wherein the surfactant is in the form of sodium dodecyl benzene.

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51. A binder composition according to any one of claims 40 to 50 which includes any one or more agents selected from the group consisting of silicones, silanes, silanols, oils, anti - corrosion agents, ultra violet light blocking agents, biocides, pH buffers, cement, ammonia, ammonium salts, plasticisers, ligna sulphinates and oxides thereof, phenols and mixtures thereof.

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52. A binder composition according to claim 51 wherein the plasticisers are selected from the group consisting of phthalates, hydrocarbons, acetates, latex and glycols.

53. A binder composition according to claim 51 or 52 wherein the ultra

violet light blocking agents are selected from the group consisting of organic phenols, phosphates and inorganic oxides.

54. A binder composition according to any one of claims 40 to 53 wherein  
5 the formaldehyde : urea ratio is between 1.5 and 2.5 : 1.
55. A binder composition according to claim 54 wherein the formaldehyde  
: urea ratio is 1.83 : 1.
- 10 56. A binder composition according to any one of claims 40 to 55 wherein  
the acid is a weak organic acid.
57. A binder composition according to claim 56 wherein the weak organic  
acid is selected from the group consisting of citric acid and acetic acid  
15 and mixtures thereof.
58. A solid aggregate matrix formed by treating a body of particulate  
material by a method according to any one of claims 1 to 20.
- 20 59. A solid aggregate matrix formed by treating a body of particulate  
material with a binder composition according to any one of claims 40  
to 57.

60. An artefact formed from a solid aggregate matrix according to claim 58 or 59.

5 61. A method of treating particulate material to form a solid aggregate matrix substantially as herein described and exemplified.

62. A method of preparing a binder composition for treating particulate material to form a solid aggregate matrix substantially as herein described and exemplified.

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63. A settable binder composition for mixing with a particulate material and setting to form a solid aggregate matrix substantially as herein described and exemplified.

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